

**REMARKS**

Favorable reconsideration and allowance of this application are solicited.

By way of the amendment instructions above, clarifying revisions of an editorial nature have been proposed for the pending claims. For example, claims 9 and 16 have been clarified to state that the chlorine dioxide treatment is carried out in several steps using multiple treatment vessels as shown, for example, in Figs. 5 and 6.

Claim 4 has also been clarified to the extent that it now recites that adding the chemical to the pulp is performed with a static mixer having a narrow lot sufficient to achieve fluidization or with a valve which exhibits a pressure difference of greater than 1.0 bar sufficient to achieve fluidization. Support for such revisions may be found in the specification as originally filed at page 13, lines 26-31.

It is suggested, therefore, that all claims now pending in this application comply fully with the statutory requirements of 35 USC §112.

**I. Response to Art-Based Rejections**

The only issues remaining to be resolved in this application are the Examiner's art-based rejections of record. In this regard, claims 1-17 attracted a rejection based on 35 USC § 103(a) as allegedly unpatentable over WO 98/400 in view of Maples et al or Niskanen. Claims 7 and 8 were separately rejected under this same statutory provision and the same applied references in further combination with WO 98/00602. As will become evident from the discussion which follows, the art-based rejections advanced in the subject Official Action are inappropriate and should be withdrawn.

Applicants note that the WO '400 reference deals with pre-bleaching of papermaking pulp before a peroxide bleaching stage. More specifically, WO '400 discloses a method in which pulp is first treated with chlorine dioxide at acidic pH,

thereafter the pulp is made alkaline to a pH of minimum 8.5, and is then treated with a chelating agent at a pH of minimum 8.5, whereupon the pulp is washed and bleached with peroxide.

However, there exist clear differences between WO '400 and the present invention. For example, in the WO '400 reference, the pulp is not washed after the chlorine dioxide treatment but instead is treated with a chelating agent. Moreover, the chelating agent treatment of the pulp takes at least 5 minutes, preferably at least 60 minutes, even several hours (page 5, line 19-21). As described in the present applicants' specification (page 9, line 12 +), it is of great importance to *minimize* the contact time between the pulp and the reaction products produced in the chlorine dioxide treatment. The studies that have been performed in connection with the present invention indicate that both the time the pulp stays in contact with the reaction products and the amount of the reaction products are detrimental to the development of the brightness. In order to solve this problem, the retention of the dioxide stage, i.e. the time from the chemical feed to the subsequent wash of the pulp, should be adjusted to be only as long as is necessary for the reactions of the lignin, i.e. until all the bleaching chemical has been consumed, and the bleaching should be stopped when the chemicals have been consumed. In this way, the time the pulp is in contact with the effluent of the bleaching is minimized and thus the bleaching losses are reduced to the minimum. In practice, the detrimental by-reactions take place shortly after the main reaction as the by-reactions require the presence of reaction products in the liquid phase. The method according to WO '400 is in stark contrast to this principle, because the pulp is not washed until *after* the treatment with a chelating agent. Such retention allows the pulp to continue reacting with the reaction products and consequently the quality of the pulp degrades.

According to one aspect of the invention (claims 9 and 16), the pulp can be treated in one or more steps. It may be necessary in the Do stage to reduce the Kappa

number, i.e. the lignin content of the pulp more than can be achieved in one tower using the low dioxide contents of the invention. It is then sensible to divide the dioxide dose preferably into two or three substantially equal portions. The addition of chlorine dioxide between treatment vessels or steps allows active adjustment of the bleaching reaction to continue during the whole retention of the steps but prevents it from continuing to a level where the bleaching chemical has already been consumed and the quality losses begin to occur without the positive bleaching effect provided by the bleaching chemical.

The Examiner argues that Maples teaches using plural stage addition of chlorine dioxide. However, the bleaching sequence of Maples is DEDP which means that there is a first chlorine dioxide stage (D), an alkaline extraction in the presence of base (NaOH), a second D stage and a peroxide stage. The pulp is washed between the stages. Chlorine dioxide is added in two stages so that there is the E stage between the two D stages. Maples does not therefore teach or disclose plural dioxide additions in one D stage.

An essential feature of the present invention is that pulp travels from the dioxide mixing to the washer in a **closed space** and thus chlorine-containing compounds are prevented from escaping to the atmosphere.

The Examiner argues that it would have been obvious to use a high intensity mixer of Maples et al or Niskanen et al in the process of WO '400. However, WO '400 deals with pre-bleaching of papermaking pulp before a peroxide bleaching stage. According to such publication, the prebleaching is effected with chlorine dioxide, which is fed in the amount of maximum 15 kg, preferably 5 – 10 kg, calculated as active chlorine, per ton of pulp. Thus, the stage in question is either a mild dioxide stage, which does not even aim at the most efficient delignification possible, or it is a stage after an especially efficient digestion and an oxygen stage, i.e. a stage where the kappa number is after an oxygen stage somewhere around five, which in its turn means that the pulp should be cooked to a kappa of about 10. In any event, the cited WO '400

publication discusses "a mild dioxide stage" (page 3, line 33). The chlorine dioxide is added primarily with the object of preoxidizing the pulp so that metals disturbing the process, primarily transient metals and especially manganese, are more exposed and can be bound more easily by chelating agents being added in a subsequent stage before a peroxide bleaching stage (page 2, line 37 +). In other words, the dioxide stage in question is clearly used for other purposes than, and is run differently from, the chlorine dioxide stage of the present applicants' invention.

Further, the WO '400 publication teaches that the dioxide charges in the stages used for the actual delignification vary between 20 – 70 kg/ton (page 4, line 9-12) depending on the presence or non-presence of an oxygen stage in the sequence. Even when fluidizing mixers have been used, the meaning of the mixing efficiency they provide in delignification has neither been understood nor made full use of.

## **II. Information Disclosure Statement**

Applicants note that the counterpart European application to the subject U.S. application is presently involved in opposition proceedings in which the Opponent has cited the following references:

WO 9800602 - cited in the WO Search Report and in the Official Action of the subject US application;

USP 4,537,652 - cited via its Finnish counterpart FI 73020 in the applicants' Supplemental Information Disclosure Statement dated March 13, 2002; and

SE 504210 - cited as prior art in the subject application at page 5, line 28 through page 6, line 9. There is no readily available English translation of SE 504210, but applicants note that it relates to a method for the multi-stage bleaching of paper pulp in

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which at least one end bleaching stage is carried out using chlorine dioxide at a pulp concentration of 10-15% for 1-90 minutes in a pressurized vessel at 90-130 deg C, 0.1-10 bar.

Consideration of the information above during prosecution of the subject application is solicited for which purpose copies of USP 4,537,652 and SE 504210 are attached hereto and listed on the accompanying form PTO-1449. The WO '602 publication has not, however, been submitted or listed as it is already of record herein.

**III. Conclusion**

Every effort has been made to advance prosecution of this application to allowance. Therefore, in view of the amendments and remarks presented above, applicants suggest that this application is in condition for allowance and early Notice to that effect is solicited.

Respectfully submitted,

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